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ABSTRACT

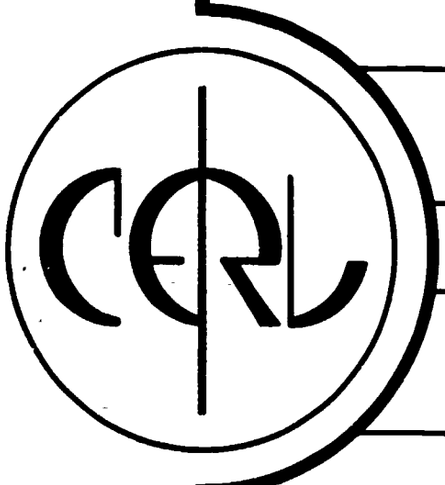
This manual provides newcomers to the PLATO computer-assisted instructional system with an introduction to TUTOR, the system's language. It explains the basic commands and specific operating instructions and presents a set of seven simple exercises, the performance of which serves as an introduction to PLATO for the user. Four appendixes are also included: A) Summary of TUTOR Commands; B) How to Predict the Operation of a TUTOR Unit; C) Aids for Authors; and D) Using the TUTOR Editor. (PB)

TUTOR USER'S MEMO

INTRODUCTION TO TUTOR

March, 1973

Computer-based Education Research Laboratory
University of Illinois at Urbana-Champaign
Urbana, Illinois 61801



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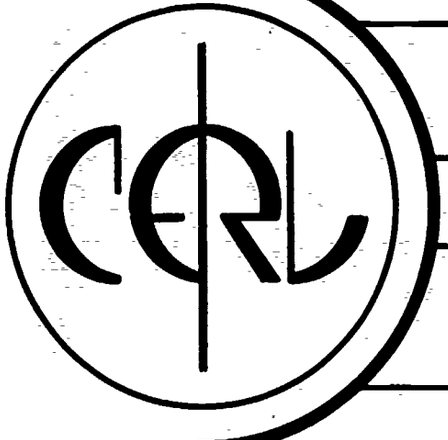

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INTRODUCTION TO TUTOR

Writing on the Student's Screen

TUTOR is the language in which instructional material is prepared for the PLATO Computer-based Education System. A lesson writter in TUTOR consists of a series of statements of the form,

```
COMMAND  TAG
```

where "COMMAND" represents an operation to be performed by the computer and "TAG" represents specific instructions for performing the operation. For example, PLATO presents information to the student by means of a display screen. One TUTOR command which permits the author of lesson material to write on the student's screen is the -write- command. The "tag" of the -write- command is simply the textual material which is to be displayed. Thus,

```
write    How are you?
```

would display the message "How are you?" on the student's screen. Since it is often necessary to be able to say exactly where material is to be displayed, the TUTOR command -at- is also available. The statements:

```
at       1020
write    How are you?
```

specify that writing of the message "How are you?" is to begin on the 10th line of the stduent's screen and at the 20th character position of that line (a PLATO screen holds 32 lines of up to 64 characters each). Once a starting position is specified for a display the -write- tag may include positioning of subsequent lines. Thus,

```
at       140
write    PAGE 2
at       1510
write    This is line 15,
         This is line 16, and
         This is line 17.
```

would display the words "PAGE 2" starting on line 1, character position 40, and would label lines 15 through 17 by displaying message contained in the tag of the second WRITE command, at positions 1510, 1610, and 1710.
Note: the -at- command sets a margin---a nice feature indeed!

Using the TUTOR Editor

A description of the TUTOR editor is included as Appendix D of this document. Also, when you are using the editor, assistance is available via the -HELP- key. Here, we merely list the steps necessary before you start the exercise sets which begin on page 3.

a) Learn the name of the lesson space assigned to you.
b) Enter the editor (See sign-on procedure in Appendix D.)
c) Type your lesson name on the EDIT OPTION page and then press -NEXT-.
   c') Specify descriptive information about your lesson. (See Appendix D for instruction.) This step is necessary only the first time you enter a new lesson. When you have finished entering the data requested, press -BACK-.
d) Press -a- on the LESSON EDIT page.
   d') Choose a name for your block "a" (This step is done only the first time you enter any block).
e) Press -i- to begin inserting the text of exercise 1. (Be sure the words "INSERT MODE" appear at the top of your screen.)

The general pattern for entering each line of TUTOR text is as follows:

1) Type the command.
2) Press -TAB- key. (located on the left-hand side of your keyboard)
3) Type the tag.
4) Press -NEXT-.
5) Repeat steps (1) through (4) for the next line of your program.

See Appendix D for details on correcting mistakes and for the various special options available to you.

Exercise Set 1

1-1. Copy these statements into a block of your lesson.

COMMAND	TAG	EXPLANATION
unit	test	
at	101	On line 1, position 1,
write	Upper left	write: "Upper left"
at	153	On line 1, position 53,
write	Upper right	write: "Upper right"
at	1601	On line 16, position 1,
write	Middle left	write: "Middle left"
at	3201	On line 32, position 1,
write	Lower left	write: "Lower left"

Read this material into the computer's memory and look at it from a student's point of view. (Press SHIFT-STOP)

1-2. Go back into Author Mode (from Student Mode, press SHIFT-STOP). Add to the program statements of exercise 1 to do the following:

a. In the center of the student's screen write the letter 'X'.

b. In the lower right corner of the student's screen write the words:

Lower right

When finished, enter student mode again to check the placement of the various messages on the student's screen.

Questions and Answers

In the previous exercises you learned a little about using TUTOR to write on a student's display screen. Using the -at- and -write- commands, you can instruct the computer to present a question to the student. For example, the statements:

```
at      503
write   Honolulu is in what state?
```

would present a question on line 5 of the screen starting at position 3. We must now learn to provide the student with a means of answering questions and to provide the computer with a

means of checking the answers given.

The presence of an acitivity requiring a student response is signaled by the statement:

```
arrow   715
```

where the tag (715) has exactly the same format and meaning as that of an -at- command. When the computer executes such a statement, it plots an arrow on the student's screen at the stated screen position. That is where the student's answer will appear when he types it. (In the above example, the student's answer will start on line 7, position 15.)

Once the presence of a response-requiring activity is signaled, we need a way to inform the computer of the response(s) to expect. The simplest such statement is one line:

```
answer  Hawaii
```

Such a statement informs the computer of a correct answer. When the student types a word that matches the tag of this statement, he is told that his answer is correct. (Even if a student misspells 'Hawaii' it will generally be recognized and underlined as a misspelling.)

In summary, a simple question-answer situation is written (in TUTOR) like this:

```
at       503                          On line 5, position 3
write    Honolulu is in what state?   write the question.
arrow    715                          Student's answer to be
                                      written on line 7
                                      starting at position 15.

answer   Hawaii                       A correct answer.
```

Exercise Set 2

2-1. Copy this program.

COMMAND	TAC	EXPLANATION
unit	math	
at	205	On line 2, position 5,
write	Answer these problems	write the directions; skip a line;
	3 + 3 =	write an addition problem, skip a line;
	4 x 3 =	write a multiplication problem.
arrow	413	Answer to the addition
answer	6	problem is 6, and goes on line 4, position 13.
arrow	613	Answer to the multipli-
answer	12	cation problem is 12, and goes on line 13, postion 9.

NOTE: We intend that you skip a line between the instructions to the students and the first problem. Also that you skip a line between problems. You should not leave other blank lines in your program. Our samples contain blank lines so that we can fit in the explanations on the right. Do not copy those blank lines.

Enter student mode (press SHIFT-STOP) and go through it as a student. Try various combinations of correct and wrong answers.

2-2. One frequently wishes to give replies to a student contingent upon specific correct or wrong answers. This exercise illustrates such a procedure. Add only the bracketed lines to the unit from Exercise 2-1. (The statements from Exercise 2-1 are in italics.)

COMMAND	TAG	EXPLANATION
unit	*math*	
at	*205*	
write	*Answer these problems.*	
	3 + 3 =	
	4 x 3 =	
arrow	*413*	
answer	*6*	
[at	420	Insert this answer contingent writing. When student answers correctly, congratulate him, putting the message on line 4, position 20.
[write	Very good	
arrow	*613*	
answer	*12*	
[wrong	7	Insert this wrong answer contingent writing for the multiplication problem. If the student accidentally adds, tell him so; starting the message at line 6, position 20.
[at	620	
[write	Multiply, do not add.	

Now read in (SHIFT-STOP) and go through the exercises as a student. Pay particular attention to the way the contingent lines of programming work. Be sure on one of your trials to answer the multiplication question (4 x 3 =) with a '7'.

2-3. On occasion, it is desired to have a message show only for one question <u>before</u> the answer is given. This is achieved by arrow contingent writing. To the material of Exercise 2-2, make these additions:

COMMAND	TAG	EXPLANATION
unit	*math*	
at	*205*	
write	*Answer these problems*	
	3 + 3 =	
	4 x 3 =	
arrow	*413*	
at	701	Arrow contingent writing placed on line 7, position 1.
write	Take you time	
answer	*6*	
at	*420*	
write	*Very good*	
no		A universal wrong contingency. No matter what <u>wrong</u> answer is given, say, "Try again." On line 4, position 20.
at	420	
write	Try again.	
arrow	*613*	
at	801	Arrow contingent writing for the multiplication question.
write	Keep calm.	
answer	*12*	
wrong	*7*	
at	*620*	
write	*Multiply, do not add.*	

Read in the lesson. (SHIFT-STOP). Observe the two examples of arrow contingent writing as well as the wrong answer contingent writing.

Separating Groups of Operations

In order to separate groups of operations which are to be performed together, the TUTOR command -unit- is used. The sequence:

```
unit    one
at      201
write   Page 1
unit    two
at      201
write   Page 2
```

will first display the words "Page 1" starting on line 2, position 1. When the student presses the key labeled "NEXT" the screen will be erased and the material in unit two will be shown. The words "Page 2" will appear. The tags of -unit- commands provide names for groups of TUTOR statements. Hence <u>all</u> of the TUTOR statments between the statement "unit one" and the statement "unit two" are referred to collectively as the "contents of unit one" or simply "unit one." Similarly <u>all</u> TUTOR statements between the statement "unit two" and the next following -unit- command are referred to as "the contents of unit two" or simply "unit two."

Exercise Set 3

3-1. Write a <u>new</u> unit that has the following problems on the screen:

275 x 32 =

15 x 5 =

a. Place this unit in the block with the material from Exercise Set 2 (just completed). Immediately after the last statement of the previous material, insert the statement:

```
unit     arith2
```

b. As an arrow contingency for problem 1, write the message:

You may use pencil and paper.

c. As an arrow contingency for problem 2, write:

Do this one in you head.

d. As a universal wrong (-no- command) for problem 1, write:

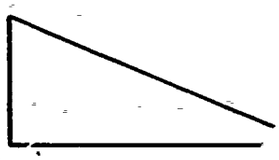
You had better use pencil and paper.

Place it near the bottom of the screen.

e. Make up one other answer-type contingency for one of the problems and include it in your program.

Sentence Answers

Many questioning situations require more than a single word response. For example, consider an exercise such as:



What type of figure is this?

>

There are several correct responses, including:

It is a right triangle.

a rt. triangle.

a right triangular figure

To instruct the computer to accept answers of this type, we build a sentence checker using three types of words:

1. Words that MUST be present to be correct.
2. Words that can safely be IGNORED.
3. Words that CAN'T be present to be correct.

Here is a statement that will correctly check answers to the triangle question:

```
answer    <It, is, a, the, it's figure, polygon> (right,rt)
          (triangle, triangular)
```

The first group of words (enclosed by < >) consists of those words that may be ignored. Following this are two groups of words enclosed by parentheses. These are the MUST words. Each set of parentheses encloses a single must-type word together with acceptable synonyms. Notice that synonyms are separated by commas. If no synonyms are listed for a MUST word, parentheses are not used.

Exercise Set 4

4-1. Here is the complete unit described above.

COMMAND	TAG	EXPLANATION
unit	triang	
figure	310,810,825,310	Draw the triangle, one segment from 310 (line 3, space 10) to 810 (line 8, space 10), a second segment from 810 to 825, and a third segment from 825 to 310.
at	1105	
write	What type figure is this?	The question.
arrow	1305	Start of answer.
answer	<it,is,a,it's,figure, polygon> (right,rt) (triangle, triangular)	
wrong	<it,is,a> square	If the student's answer includes the word 'square', give him this message.
at	1501	
write	A square has four sides.	

a. Copy this unit. For ease of viewing as a student, put it <u>ahead</u> of the units containing material from the previous exercise sets.

b. Read your lesson into the computer memory. (SHIFT-STOP)

c. Try the following answer variations, noting the computer's response each time:

i. it is a triangle, right? (to see response to incorrect word order)

ii. it is a right triangel. (to test spelling)

iii. it is a squair. (to test spelling on a wrong)

iv. it is a beautiful right triangle. (to see response to extraneous words)

4-2. Write a new unit that asks the questions:

What explorer discovered America in 1492?
What ships were used in his voyage?
You design the answer provisions for each question.

Sequencing Units

The tags of -unit- commands may also serve as "addresses." If the author wants his units to be seen by the student in an order other than the sequence in which they are written, he may alter this sequence by using -next- commands. -next- uses the name of a unit as its tag. Here is an example of the use of -next-.

```
unit    one
next    two
write   Page 1
unit    hidden
write   This message will not be seen by the student
unit    two
write   Page 2
```

The student first sees the words "Page 1" (on line 1, beginning at postion 101 since no -at- command is given). When the student presses -NEXT-, the screen is erased and the words "Page 2" appear. In this example, the unit named "hidden" is never seen by the student.

The -next- command can also be used to create repetitive type exercises as is illustrated in Exercise Set 6.

Student Initiated Branches

The -HELP-, -LAB-, and -DATA- keys and the shifted-HELP, shifted-LAB, and shifted-DATA keys do not function for students unless they have been enabled by the lesson author. By inserting the commands -help-, -lab-, -data-, or -helpl, -labl-, datal-, an author enables the corresponding key. The suffix "l" refers to the shifted keys.

The following units show a use of the -HELP- key. Any of the other five keys could have been used in precisely the same manner.

Exercise Set 5

5-1. Copy these units into your lesson space.

COMMAND	TAG	EXPLANATION
unit	jef	
next	mad	unit mad will follow when unit jef is completed.
at	810	
write	Who was the THIRD President of the United States?	
help	hint1	enable the -HELP- key. If a student presses -HELP-, show him unit hint1.
arrow	1210	
answer	<T, Thomas, Tom> Jefferson	
unit	hint1	These help units merely give hints.
at	410	They might have asked
write	He was a Virginian.	questions too.
at	1810	
write	Press -NEXT- for another hint.	
		skip a line
	Press -BACK- if you would like to answer the question.	
unit	hint2	
at	610	
write	He was also the chief author of our Declaration of Independence.	
		an -end- command signals the end of a sequence of help units.
end		

(NOTE: The program for Exercise 5-1 continues on the next page.)

```
unit     mad
at       1810
write    Which President
         followed Jefferson?
arrow    1210
specs    nocaps
answer   <james>  madison
```

Specify that we wish to accept the answer with or without capitalization. With specs nocaps in effect, no capitalization should appear in the tag of the -answer- commands.

Try these units as a student. Go through them at least twice, once without pushing -HELP-, and once with help.

5-2. Write one or more help units for unit mad. Place them after unit hint2. Check them in student mode.

Student Variables

Each terminal has reserved for it a set of 150 computer words called Student Variables. These variables are numbered from 1 through 150. Each such variable can be thought of as an individualized storage location for various types of information.

Probably the most important use of the student variables is personalized calculation. A simple example of this is the task of keeping records on the number of problems worked and the number of errors made by each student. For such an application we interpret a variable as a storage location for a number. When referring to, say, variable 5, and wanting it interpreted as a rational number in decimal notation, we call it:

v5

Later you will learn to use these same 150 student variables as storage locations for alphabetic strings, or as storage locations for integers.

Exercise Set 6

6-1. Here is a unit that randomly selects one digit addends for a continuous addition drill. An explanation of the lines is at the right.

COMMAND	TAG	EXPLANATION
unit	adrill	
randu	v1,9	Randomly select two numbers between and including 1 and 9; put the first number in student variable v1, the other number in v2.
randu	v2,9	
calc	v3 ← v1 + v2	Calculate correct answer; put it in student variable v3.
at	410	On 4th line, 10th space---
show	v1,1	show first addend; only 1 digit---
write	+	then show other addend, allowing 2 spaces, one to separate the + and the numeral---
show	v2,2	
write	=	then write an equal sign with a space before it. At this stage the student sees something like: 7 + 8 =
arrow	422	Include -arrow- to indicate that a response is required and to separate display commands from response command.
ansv	v3	Check for correct numerical answer, allowing no difference from contents of v3 (the actual answer).
next	adrill	Repeat the unit.

a. Read in the unit. Work a few problems as a student, noting what happens on wrong answers.

b. To exit this continuous drill, press SHIFT-STOP.

6-2. Unit adrill is not very flexible. It gives the student no information on how close he is to being correct. Let's fix that.

COMMAND	TAG	EXPLANATION
unit	*adrill*	
randu	*v1,9*	
randu	*v2,9*	
calc	*v3 ← v1 + v2*	
at	*410*	
show	*v1,1*	
write	*+*	*as in Exercise 1*
show	*v2,2*	
write	*=*	
arrow	*422*	
ansv	*v3*	
next	*adrill*	
wrongv	v3,1	See if student's answer is within 1 of the correct answer (v3)---
write	You're off by 1.	if so, tell him---
wrongv	v1 x v2	check for wrong arithmetic operation.
write	You are multiplying!	tell student.
no		For any other incorrect answer--
write	you're way off.	tell him.

Try several problems as student to check the wrong-answer contingent messages.

The author of a lesson which uses lots of variable can easily become confused about which variables he is using for each purpose. One aid to remembering the assignment of variables is to give them mnemonic names.

The -define- command associates such names with variables (or functions of variables). Below we have rewritten unit adrill with defined names in place of v1 and v2. Change your copy of adrill to match ours.

```
unit     adrill
define   mynames
         first=v1, second =v2
         result=v3
randu    first,9
randu    second,9
calc     result←first + second
at       410
show     first,1
write     +
show     second,2
write     =
arrow    422
ansv     result
next     adrill
wrongv   result,1
write    You're off by 1.
wrongv   first x second
write    You are multiplying!
no
write    You're way off.
```

A lesson may contain several sets of defines; therefore each set is given a name. (We've used the name "mynames.") Following the set name are mnemonic names and the variables to which they shall refer.

Try the new unit adrill as a student. It should function precisely as did the first version.

6-3. The unit in Exercise 6-2 goes on <u>forever</u>. Let's change it so that after we have worked <u>four</u> problems correctly in a row, we end the drill and tell the student how many errors he made. To do this, we need a counter (let's define worked=v10) for the number of problems worked correctly and a counter for the number of errors (use errors=v11). However these counters must be set to <u>zero</u> before we begin the drill. This requires a new unit <u>before</u> adrill. Also, since the define command must preceed any use of the defined names, we must move the define command into this new unit.

COMMAND	TAG	EXPLANATION
unit	initial	
define	mynames first=v1,second=v2 result=v3 worked=v10,errors=v11	
calc	worked ← errors ← Ø	Set both counter to zero...
jump	adrill	jump immediately to unit adrill; <u>do not</u> wait for student to press -NEXT-. The student is never aware of being in unit initial.
unit	*adrill*	
randu	*first,9*	
randu	*second,9*	
calc	*result ← first + second*	
	worked ← worked + 1	Increment problem counter every time we choose a new problem.
at	*410*	
show	*first,1*	
write	*+*	
show	*second,2*	
write	*=*	

```
    arrow     422
    ansv      result
[   next      worked - 4, adrill,
              report                    Remove the old -next-
                                        command. Use a
                                        conditional -next-.
                                        as long as worked - 4 is
                                        negative, (i.e., worked
                                        is less than 4) repeat
                                        the drill. When
                                        worked - 4 = 0, (i.e.,
                                        worked = 4) unit report
                                        is next.

    wrongv    result,1                  as in Exercise 6-2.
[   calc      errors ← errors + 1
              worked ← 0
                                        Count an error when off
                                        by 1. Set problem
                                        count back to 0 because
                                        an error was made.

    write     You're off by 1.
    wrongv    first,second
    write     You are multiplying !
[   calc      worked ← 0
              errors ← errors + 1       Reset problem count.
                                        Count an error.

    no
[   calc      errors ← errors + 1       Count an error on all
              worked ← 0                other wrongs also. Re-
                                        set problem count to 0.

[   write     You're way off.           as in Exercise 6-2.
    unit      report
    at        805
    write     You correctly worked      Report the results---
              four problems in a
              row.
              Before that you made      Number of errors from
    show      errors,2                  errors. Allowing 2
    at        1210                      character spaces.
    write     That's all for now.
```

Read in and check all contingencies, including the score keeping. (Be sure to make some errors.)

6-4. Make a drill lesson with the following characteristics. Put it in a new unit ahead of all previous units.

a. A multiplication drill with the first factor a two digit number (i.e., between 10 and 99 inclusive) and the second factor a one digit number.

b. Write the problems in horizontal format (i.e., 27 x 3 =).

c. Count the problems worked and end the drill after the 8th problem.

d. Provide the following information to the student on wrong answers:

i. If within 1 of the correct answer, tell him so.

ii. If within 10% of the correct answer, say, "You're close." (Use the statement

wrongv ___,10%

for this, filling the blank with the name of the variable you are using.)

iii. If the student accidentally adds, tell him he has added, and count it as an error.

iv. On all other errors say, "Try again."

e. When the drill is finished report the number of errors to the student.

Try the lesson as a student to see that it works as described.

Joined Units

One frequently writes material that is used in several units. Such material might be a graph or other display that is repeated, or it might be a large set of answers used for several questions.

Of course, the material could be repeated at the point of each use. This is usually wasteful of both computer space and author time. A more efficient way is to put the material to be repeated in an out-of-the-way unit. The -join- command, using the name of the out-of-the-way unit as tag, causes the computer to act as though the material were inserted at the appropriate points.

The following example illustrates some uses of the -join- command.

```
unit     boxes
define   place,origin=v1
calc     origin ← 915
join     box                          Draw a box at 915.
calc     origin ← 2030
join     box                          Draw a box at 2030.


unit     box                          Draw a box whose upper
line     origin,origin + 200          left corner is specified
line     origin + 200,                by orgin.
           origin + 204
line     origin + 204,
           origin + 4
line     origin + 4,origin
```

In Exercise 6-3 (the addition drill) it would have been convenient to use a joined unit instead of thrice repeating the lines:

```
calc     errors ← errors + 1
         worked ← Ø
```

Each occurrence of those two lines could have been replaced by

```
join     count
```

where "count" is the name of a unit included somewhere in the lesson having the form:

```
unit     count
calc     errors ← errors + 1
         worked ← Ø
```

Exercise Set 7

7-1. This exercise illustrates a way to have a set of several exercises executed in a different order by each student, or by a given student going through them several times. Put this in a new unit ahead of all previous units.

COMMAND	TAG	EXPLANATION
unit	start	
define	medley,choice=v10	Add defined names here as you find you need them.
at	402	
write	Press next to begin the drill	An entry unit---
setperm	6	constructs a set of integers 1 through 6 from which draws will be made later.
unit	branch	
randp	choice	Randomly select one of the integers provided by the -setperm- command (without replacement) and put it in variable choice. When all choices are used put zero in choice.
jump	choice,done,done, b1,b2,b3,b4,b5,b6	Go immediately to the exercise indicated by the value in choice. Do not wait for the student to press NEXT.

a. UNIT B1 is to be the following exercise, written as shown, near the middle of the screen:

```
  56
+ 29
```

This unit should contain the line:

next branch

somewhere before the -arrow- command. Put in whatever answer contingencies you wish.

b. UNIT B2 is to ask the student to name the 49th and 50th states. (Include the line: next branch in this unit also).

c. Units B3 through B6 should be exercises of your design. (Include: next branch in each.) Try to include at least one sentence judging situation.

d. Finally, include the following:

```
unit    done
at      503
write   You have finished the lesson.
end     lesson
```

Test these six exercise.

7-2. You have now completed 7 exercise sets. In a new unit ahead of the previous ones, build an index which shows the student a numbered list of descriptions of the material in the various exercise sets. Tell the student to press the number of the exercise he wishes to see. Correct answers consist of the numbers, each followed by a -jump- to the beginning unit of that exercise. Include in your index unit the line:

```
term    index
```

This will permit the student to return at any time to the index for another choice by pressing the -TERM- key, typing the word index, and pressing -NEXT-.

APPENDICES

APPENDIX A

Summary of TUTOR Commands

To be useful this summary must be brief. For more information on the commands (exceptions, special uses, etc.) see the various author aids that are available. (See Appendix C.) The classification scheme in this list is identical to that in lessons aid2 and aid3.

PRESENTING

Screen text

at	specifies starting position of display on plasma panel
write	displays message on the plasma panel
writec	displays one of a series of messages contingent on the value of an expression
show	displays the value of a variable (base 10) in the specified format
showo	displays the value of a variable in octal notation (base 8)
showa	displays stored or packed characters from variable(s) specified in tag
erase	erases screen, selectively or entirely
mode	specifies terminal writing state
inhibit	temporarily disables certain normal actions of TUTOR
size	changes to line-drawn characters larger than normal characters, size specified by tag
rotate	causes line-drawn characters to be written at an angle specified in the tag
delay	permits specification of short output delays
char	permits specification of specially designed characters for display
plot	displays special characters specified by -char- command
codeout	specifies code sent to terminal to perform special display functions

Screen graphics

line	draws line on screen between locations specified in tag
liner	draws line from last writing location to location specified in tag
figure	draws connected lines from tag1 to tag2 to tag3...to tag50 locations (coarse grid)
figuref	draws connected lines from tag1, tag2 to tag3, tag4...to tag49,tag50 (fine grid)
circle	draws circle with relevant parameters set in tag
circleb	draws broken circle
dot	plots single dot on screen at tag location
window	delimits area on line-drawn display on plasma panel

Grafpack commands

origin	specifies position for origin; all other plotting and writing with grafpack commands are relative to origin
axes	specifies and draws axes
bounds	establishes boundaries on axes but does not draw axes
frame	draws frame around boundaries specified in tag or by previous -axes- or -bounds- commands
scalex scaley	specifies maximum (and minimum if given) values on axes (all subsequent commands are in scaled units)
locate	similar to -at- but relative to origin and in scaled units
graph	places dot or other specified character string at position indicated relative to origin and in scaled units
gline gliner	like -line-, -liner- commands except relative to origin and in scaled units
labelx	labels x axis (numbers and tick marks)
markx	tick marks only
labely	labels y axis (numbers and tick marks)
marky	tick marks only
vbar	draws vertical bar relative to origin, in scaled units
hbar	draws horizontal bar relative to origin, in scaled unit

Non-screen

slide	turns on slide projector and selects slide specified in tag
audio	plays audio message specified in tag
play	plays back audio recording, with message location specifed in tag
record	records message at location specified in tag
enable	allows inputs from external device (e.g., touch panel)
disable	refuses inputs from external device (e.g., touch panel)
ext	sends value of tag variable to external accessory

Special typing controls

tabset	sets tabs which can be used by student pressing -TAB- key
copy	specifies string which is to be copied when -COPY- (carat) key is pressed
micro	specifies micro table definitions used when the student presses -MICRO- key and then another specified key
charset	causes character set specified in tag to be loaded into terminal memory

CALCULATING

Basic calculating

add1	adds 1 to variable specified in tag
sub1	subtracts 1 from variable specified in tag
zero	sets variable specified in tag to zero
define	permits author to rename a variable or define a mathematical function for a lesson
calc	assigns value of expression on right side of assign arrow to TUTOR variable on left
calcc	does one of several possible calculations depending on value of an expression
branch	(not a command) when placed in tag field of a continued -calc- permits branch to another line in the continued -calc-

Random numbers

randu	provides random numbers, sampled with replacement

setperm	sets up two lists of random permutations of integers from 1 through value specified in tag
randp	selects randomly from setperm list without replacement
remove	removes specified values from one of setperm lists
modperm	refills first setperm list with second setperm list

Special calculating

clock	puts alphameric string in tag variable giving time on 24 hour clock (not to be confused with the system variable "clock")
date	puts character string in tag variable for current month/day/year
day	places in tag variable the number of days elapsed since midnight December 31, 1972 to nearest 10^{-6} day (approximately 1/10 second).
pack	packs specified string, left-justified, in specified variable
compute	compiles specified character string, executes, and stores result in specified variable
find	searches set of variables for specified character string in a specified position within a variable
search	searches set of variables for specified character string of 10 characters, independent of position within a variable
move	moves one character from one specified variable and character position to another
movebit	moves bit(s) from one specified variable and bit position to another
block	copies set of variables into another set
common	sets up storage space which is accessible to all students in a particular lesson
unloadc	saves temporary variables in lesson common
loadc	reloads temporary variables from common to where they are accessible to students

SEQUENCING

Basic sequencing

unit	identifies a section of a lesson
entry	provides alternate entry point to a unit

base	resets main sequence
end	terminates branch sequence
arrow	places arrow on screen at tag location; waits for student response
long	sets maximum length of student response (default is 79 characters)
jkey	specifies keys which will initiate judging in addition to -NEXT- key
start	indicates following material is to be condensed
stop	indicates following material is not to be condensed--- in effect up to next -start- command, if any
*	indicates statement on that line is a comment only and is to be ignored by the computer
$$	(not a command) when placed on same line as TUTOR statement indicates that material following is a comment

Author-specified branch

next	permits movement to another unit by pressing -NEXT- key (resets base unit if in main sequence)
nextnow	terminates processing in a unit and makes only -NEXT- key active
jump	causes immediate movement to unit named in tag with change of base to that unit (if in main sequence)
goto	causes movement to unit named in tag without change of base but without return to original unit (for exception see full description)
join	causes temporary movement to unit named in tag with return to original unit
do	causes repeated -join-s of unit named in tag
exit	permits termination of -do- or -join- sequence
iferror	causes a -goto- to unit in tag if error is found in a -calc-
jumpout	jump to specified unit in the lesson named in the tag

Student-initiated branch

help	permits branch by pressing -HELP-
helpl	permits branch by pressing shifted -HELP-
lab	permits branch by pressing -LAB-
labl	permits branch by pressing shifted -LAB-

data	permits branch by pressing -DATA-
datal	permits branch by pressing shifted -DATA-
back	specifies unit entered when -BACK- key is pressed
term	permits branching to a unit containing -term- and the string typed as the tag

Timing

pause	delays execution of subsequent statements (minimum .75 second)
time	presses -TIME- key after time specified in tag
press	puts key named in tag into student input buffer
break	interrupts computer if time-slice is about to be exceeded or output-overflow is about to occur.
return	similar to -break- but interrupts processing unconditionally

JUDGING

Always end judging

ok	(no tag) judges ok
no	(no tag) judges no
ignore	(no tag) ignores and erases student response
match	searches student response for occurence of any of key-words listed in tag

Sometime end judging (m=end if tag matched, e=end if error detected)

answer	checks student response against tag (m)
wrong	checks student response against tag (m)
list	sets up list of synonyms for judging (not executable)
ansv	checks student response against first argument in tag, with tolerance set by second argument (m)
wrongv	same as ansv except for incorrect response (m)
ansva	checks numerical or algebraic student response against first argument in tag, with tolerance set by second argument (m)
vocab	sets up list of ignorable words and synonymous important words (not executable)
concept	checks student response against tag, using vocab list (m)

touch	specifies location of touch square (m)
store	calculates numerical value of student response and stores it in variable specified in tag (e)
storen	searches for and evaluates simple numerical expressions in student responses and stores result in specified variables (e)
exact	checks student response with tag for exact character string match (m)
exactc	checks student response for exact character string match with one of several arguments in the tag contingent upon the value of an expression

Never end judging

join	see description under sequencing
storea	stores characters from student response, left-justified, in specified variable (and succeeding variables, if necessary)
specs	permits alteration of judging process
or	provides alternative answers to a previous judging command
bump	removes specified characters from student response before judging
put	replaces one character string in student response with another
putd	similar to -put- but allows any delimiter between character strings
open	places characters of student response, one-by-one, in successive variables starting at tag variable (right-justified)
close	takes characters stored in right-most six bits from successive variables and makes judging copy for use by judging commands

Alters judging

judge	(<u>not</u> a judging command) alters previous judgment

APPENDIX B

HOW TO PREDICT THE OPERATION OF A TUTOR UNIT

When a TUTOR unit is written, the commands are entered in a list. But when that unit is controlling PLATO, the commands generally do not get used in the order they appear. The chart below can help you predict the seauence of commands during execution of a unit.

TUTOR EXECUTION CYCLES

PLATO's Action	Student's Actions	Remarks
1. Start at -unit- Do REGULAR commands. If -arrow- is encountered, remember its location. Continue processing REGULAR commands. Stop at -unit- or JUDGING command. 1a. If no -arrow- in unit, Wait for -NEXT-. Start cycle 1 for next unit. 1b. If -arrow- in unit, wait for student response.	Students presses -NEXT-. Student responds. Student presses -NEXT-.	a. '-arrow-', '-unit-' and '-specs-' are abbreviations for 'arrow command', 'unit command', and 'specs command'. '-NEXT-' is an abbreviation for 'the key on the keyboard which is labeled NEXT'. b. See the "aids" lessons (aid 1, aid 2, aid 3) to learn which commands are REGULAR and which are JUDGING. REGULAR commands include -write-, -calc-, -goto-, etc. JUDGING commands include -answer-, -ansv-, -specs-, etc. c. -join- is sometimes a REGULAR command and sometimes a JUDGING command. During cycles 1,3,4, and 5a, -join- is a REGULAR command. During cycle 2, -join- is a JUDGING command.
2. Start at -arrow- Skip REGULAR commands. Do JUDGING commands. If SPECS in encountered, remember its location. Stop at "matched" JUDGING command or -arrow- or -unit-.		

PLATO's Actions	Student's Actions	Remarks
3. Start immediately at "matched" JUDGING command. Do REGULAR commands. Stop at JUDGING command or -arrow- or -unit-.		d. A "matched judging command is one whose tag specifies an anticipated response which is "sufficiently close" to the actual student response. That particular judging command, and those that preceed it, define "sufficiently close".
4. Start immediately at -specs-. Do REGULAR commands. Stop at JUDGING command. 4a. If judgement was "no", wait for student to change response. Start cycle 2. 4b. If judgement was "OK". Start cycle 5.	Student enters new response. Student presses -NEXT-.	e. If ever a -jump- is executed while doing REGULAR commands (i.e. during cycles 1,3,4, or 5a), cycle 1 of the "jumped-to-unit" will begin. Remaining cycles of the "jumped-from unit" will not get done.
5. Start at -arrow-. Seek -arrow- or -unit-. 5a. If -arrow-, Remember location of -arrow-; Do REGULAR commands. Stop at JUDGING command. Wait for student response. Start cycle 2. 5b. If -unit-, Wait for -NEXT-. Start cycle 1 for next unit.	Student presses -NEXT-.	f. This chart does not include the sequences of events which follow if -ignore- is encountered during cycle 2 or -judge- is encountered during cycle 3.

APPENDIX C

Aids for Authors

There are several lessons intended to assist authors. They are available from any terminal. Some of them are listed below:

Lesson Name	Description
(a) graphd	How to write and draw on the screen. Includes writing in various sizes, drawing lines and circles, etc.
(b) calcd	How to use TUTOR variables to keep records and perform calculations.
(c) tutor	Description of the most commonly used TUTOR commands.
(d) aid1	General reference on PLATO and TUTOR.
(e) aid2; aid3	Reference manuals for the TUTOR language.
(f) grafpack	Reference manual for special graph-making commands.
(g) service	Helps authors generate complicated displays and individual characters.
(h) charset	Helps authors create new character sets.

Help is also available from the staff of CERL; do not hesitate to ask for assistance.

Announcements about changes in TUTOR and answers to users' questions appear in the lesson space called notes. (Enter notes via the editor, not as a student.) You may enter questions in notes. They will usually be answered within 24 hours. (The change code is notes.)

APPENDIX D

Using the TUTOR Editor

The editor for TUTOR lessons is itself a TUTOR lesson, and has many aids for TUTOR authors incorporated into its structure. At critical points, if you become momentarily confused about what you may do next, you may usually obtain aid by pushing the -HELP- key. Consequently there is little need for a comprehensive printed guide to TUTOR editing. This brief note is intended to guide new TUTOR authors who have not learned yet what key to push to get from "here" to "there".

SIGNING ON AS AN AUTHOR

1. When you sit down at the terminal, if the screen is blank, or if you see anything except the Press NEXT to Begin message, press the -BACK- key until this message appears. (If the -BACK- key does not bring you the Press NEXT message, press the shifted -STOP- key then press the -BACK- key several times.)
2. Press -NEXT- to go to the SIGN-ON page.
3. On the SIGN-ON page, type your name and press -NEXT-. Then in the space saying "Type Course Name" type instead the word "author" (or just "a") and press -NEXT-. Type your own ID code (whatever you wish), and push -NEXT- to go to EDIT OPTION page.

TO REQUEST A NEW LESSON

1. On the EDIT OPTION page, type "request" and press -NEXT-. Follow directions on the REQUEST page to get to the NEW LESSON page.
2. On the NEW LESSON page, enter your name, the name of the lesson you wish to create (up to 10 characters), and your telephone number.

3. Later that day, the machine operator will create the lesson for you if you have permission.
4. You may check to see if your lesson has been created after a few hours, by going to the EDIT OPTION page as specified in the SIGN-ON procedure, then typing the desired lesson name. If you receive a NO SUCH LESSON message, the lesson has not yet been created. Have patience.

TO SPECIFY DESCRITIVE INFORMATION ABOUT YOUR LESSON

1. The first time you enter your lesson by typing its name on the EDIT OPTION page, you should fill in the descriptive data requested on the DATA page. Type the number corresponding to the datum you wish to enter, type the information requested, then push -NEXT-. When you are through with this DATA page, push -BACK- to begin editing your lesson on the LESSON EDIT page. Type your last name first, (e.g., Bitzer, Donald L.), so that lessons can automatically be alphabetized by authors' names. Data like your name, department, and phone number are obvious. The "change code" is the security code someone must use to edit or change the lesson. Make sure you remember it or you will not be able to edit your own lesson without help from the machine operator!! If you leave the "change code" blank, anyone may edit your lesson. The "inspect code" is the security ID code anyone must have to look at your lesson. If you don't mind who sees it, leave it blank. Finish with a brief one-line description of your lesson. (You may change any of this data later by entering your lesson and pushing -DATA-.)
2. When you reach the EDIT OPTION page, type the name of your lesson and push -NEXT-. You will reach the LESSON EDIT page which lists the name of your lesson, the time, and letters a-n specifying one or more "blocks" of lesson text contained in your lesson.

3. When you enter a brand-new lesson (after specifying the descriptive data) there will be only one block (labeled "a") with approximately 300 words (computer words of 10 character codes each) of space in it.
4. Lessons are divided into blocks to optimize edit time and memory space requirements. Each block may contain up to about 60 lines of 50 characters each, or (more typically) about 100 lines of 30 characters each.
5. You may give the blocks descriptive names so that you can more easily remember what is in which block. Several blocks may have the same name if you wish.
6. TO EDIT A SPECIFIC BLOCK: Push the letter corresponding to the block label, and you will be taken to the BLOCK EDIT page.
7. TO START A NEW BLOCK: If you wish to start a new block AFTER block "a", push SHIFT-A. You will be sent to the NEW BLOCK NAME page where you may enter a name for that block, then you press -NEXT- to go to the BLOCK EDIT page.
8. TO DESTROY A BLOCK: There is no special option for this. The block will automatically disappear when all text has been deleted from it.
9. TO COPY A BLOCK: Use the SAVE option on the BLOCK EDIT page, start a new block, and INSERT the SAVE'd lines into the new block.
10. Lessons with many blocks may be split into PARTS because there are too many blocks to show on one LESSON page. To go to the PART 2 page from PART 1, push the + key. Push the - key to return to PART 1 from the PART 2 page.

EDITING A BLOCK OF LESSON TEXT

1. The lesson and block name will appear at top left and center of the BLOCK EDIT page, along with the space (in computer words) left in that block. You may enter editing commands from the keyboard which will appear on the screen at the top left.

2. EDIT COMMANDS (Enter command, then push NEXT)

f4	roll the display forward (up) 4 lines
b20	roll the display back (down) 20 lines
i3	insert new lesson text after line 3 on the screen (Important: use TAB key to separate command and tag.)
r5	replace lesson text starting with line 5 on the screen
d50	delete 50 lines starting from the one at the top of the screen (to activate this option, you must push SHIFT-HELP)
s14	save 14 lines starting from top of screen and put in "save buffer".
is2	insert the "saved" lines after line 2 now on the screen.
u	proceed to the next unit and display it starting at line 1.
uwhee	proceed to unit "whee" (if it is in this block)
pnext	proceed to first following line containing a TUTOR "next" command. Any characters may follow the p (e.g., Pca - proceed to next line which starts with "ca")
xdog	search block for the next line containing "dog" and bring it to top of screen. (any character string may follow the x) The search is "circular" through the block.
+ or -	roll screen up or down one line
x of ÷	roll screen up or down ten lines
space	continue filling screen with more lines of text following the line at which it stopped.
ℓ7	Show 7 lines of text on the screen before stopping. (Normal option is 10 on entering lesson).
out	escape from a major blunder (like deleting too much) without transferring edits you have made in this block back to disk.

3. Pressing NEXT without entering any edit command will <u>repeat</u> most previous commands. If no number is entered after i,f,b, d, or r, a one is understood. Therefore a "f" command by itself meanf "f1".

USING THE COPY AND EDIT KEYS

1. The -COPY- and -EDIT- keys work as they do in TUTOR lessons.
2. The -COPY- key (having a carat on the keycap ∧) will copy into a line being "inserted" or "replaced" from the line appearing immediately above it on the screen. Each push of the -COPY- key will copy another "word" (any characters bounded by spaces or punctuation) into the line being worked on. At any point, pushing the SHIFT-COPY key will copy the rest of the line.
3. The first push of the -EDIT- key (having a square on the keycap) will wipe out the entire line being worked on. Successive pushes of -EDIT- will return "words" to that line one at a time, in a fashion similar to the COPY key. SHIFT-EDIT copies in the remaining words in the line.
4. The -ERASE- key erases one character at a time. The SHIFT-ERASE key erases one word in the worked-on line at a time.

TESTING THE LESSON YOU ARE EDITING

1. Pressing SHIFT-STOP while editing a lesson will condense that lesson and send you into the lesson as a student. When finished testing your lesson, press SHIFT-STOP to again return to editing without passing through the entire sign-on sequence again.
2. If you sign on as a student (type "student" or "s" on the SIGN-ON page), you may test or demonstrate any lesson by typing its name on the TUTOR display page.
3. To enter the editor from the TUTOR page, type "edit" instead of a lesson name.
4. Press -p- on the LESSON EDIT page to specify which blocks are to be condensed and which are not.

GENERAL INFORMATION

1. Pressing -BACK- will take you from the BLOCK EDIT to LESSON EDIT to EDIT OPTION page to ENTER ID page to TUTOR page to Press NEXT to Begin. Back out all the way when finished to prevent anyone from using your ID and editing YOUR lesson inadvertently.
2. Pressing -STOP- while text is being displayed will immediately stop the display and await a new command.
3. To request a printout, type "request" on the EDIT OPTION page and follow instructions.
4. If you have comments about the behavior of TUTOR or general messages of interest to other authors, type "notes" on the EDIT OPTION page and enter your note in the latest block, just as if you were editing a lesson.